Augmented Democracy
Procedural Coherence in Algorithmically Mediated Governance

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The Problem: Democracy Under Attack

Traditional Voting Assumes:

- One person, one vote
- Voters are informed
- Votes are independent
- Results reflect genuine preference

Reality in 2024:

- Sybil attacks (fake identities)
- Bribery and vote buying
- Coordinated manipulation
- Bot voting
- Information warfare

Question: Can we detect manipulation *without* deciding what's "true"?

The Key Insight

We Cannot Algorithmically Determine Truth

Any system claiming to verify "facts" must answer: *who decides what counts as verified?*

But We Can Measure Process Quality

Statistical properties of *how* a decision was made reveal manipulation—independent of *what* was decided.

Artifacts, Not Truth

Facts as verifiable artifacts with provenance—not semantic claims about reality.

What is Augmented Democracy?

Definition

Augmented Democracy is a governance framework where:

1. Human deliberation drives decisions
2. Algorithmic infrastructure preserves process integrity
3. The system constrains *how* decisions are made
4. The system does **not** constrain *what* is decided

Key Properties:

- **Procedural**, not substantive
- **Infrastructure**, not oracle
- **Coherence**, not correctness

The Dual Condition

A proposal passes if and only if **both** conditions hold:

1. Majority Condition

$$W_{\text{approve}} > W_{\text{reject}}$$

Weighted votes in favor exceed those against.

2. Coherence Condition

$$\gamma > 50$$

Process quality score exceeds threshold.

Majority alone is not sufficient.

Even 90% approval can be rejected if coherence indicates manipulation.

What is Coherence (γ)?

Definition

$$\gamma = \frac{\sigma_\eta^2}{255} \times 100$$

Entropy-weighted variance of voting patterns, normalized to [0, 100].
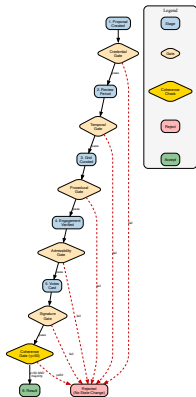
What it measures:

- Statistical independence of votes
- Proper distribution of random entropy
- Absence of coordinated patterns

What it does NOT measure:

- Whether the proposal is "good"
- Whether voters made the "right" choice
- Semantic correctness of any claim

The Coherence Pipeline

Six stages, multiple gates, single invariant.

Stage 1-2: Submission and Review

Proposal Submission

- Valid credential required
- Security deposit posted
- Artifact references declared

Review Period

- 7-day amendment window
- Community discussion
- Artifact verification

Artifact Admissibility

Referenced "facts" must have:

1. Cryptographic hash or DOI (content-addressable)
2. Authentic issuance (verified source)
3. Contextual relevance (domain match)

Stage 3: Engagement Verification (Test Grids)

Token-Curated Test Grids

- Domain-specific question pools
- Maintained by staked curators
- Voters must pass verification
- 70% threshold to vote

Curator Accountability

- Slashed for inaccessibility
- Slashed for ambiguity
- Slashed for irrelevance

Critical Limitation

Curators are **never** slashed for contested conclusions.

Test grids define *admissibility criteria*, not semantic truth.

Stage 4-5: Weighted Voting

Vote Weight Calculation:

$$w = r \times (1 + \epsilon)$$

- $r \in [0, 1]$: Credential score (reputation)
- $\epsilon \sim \text{Uniform}(-0.1, 0.1)$: Quantum entropy injection
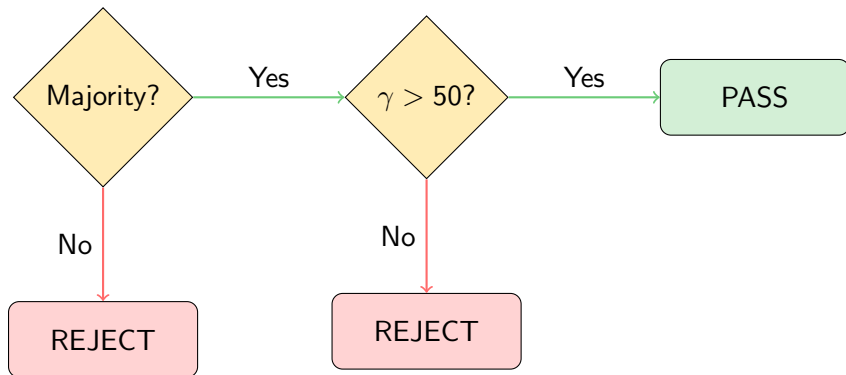
Quadratic Voting Costs

$$\text{cost}(n) = n^2$$

- 1 vote costs 1 token
- 10 votes cost 100 tokens
- Reduces whale dominance

Life-Sustaining Credentials

- 5% decay per epoch
- Participation earns bonus
- Inactivity accelerates decay
- Cannot be "parked"

Both conditions must be satisfied.
Even overwhelming majority fails without process coherence.

Threat Detection Matrix

Attack Vector	Defense Mechanism	Detection Rate
Sybil (fake identities)	Coherence gate (γ)	$> 95\%$ for $n > \sqrt{N}$
Bribery (vote buying)	Coherence + Quadratic	$> 90\%$
Coordinated manipulation	Coherence gate (γ)	$> 95\%$ for $> 10\%$
Bot voting	Engagement verification	$> 99\%$
Unengaged voting	Test grid	$> 95\%$
Whale domination	Quadratic costs	Linear $\to$ Square root
Replay attacks	Quantum signatures	100%

Key: Detection is statistical, not absolute. Thresholds are configurable.
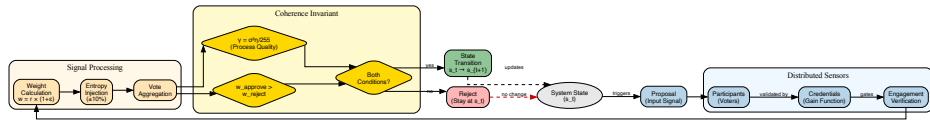
What Coherence Does NOT Detect

Formal Limitations

The following are **not** detected by γ:

1. **Genuine shared preferences**—Large groups with authentically similar views
2. **Information cascades**—Organic convergence after public deliberation
3. **Gradual ideology shift**—Slow coordination over multiple epochs
4. **Semantic manipulation**—Proposals that are procedurally correct but substantively harmful

These require: Diverse curation, deliberation periods, human oversight, constitutional constraints.

Coherence as Lyapunov Function: System stability proven via process quality bounds.

Control-Theoretic Properties

System Tuple:

- S: State space (parameters, treasury)
- A: Actions (proposals, votes)
- T: Transition function
- I: Invariant (dual condition)
- R: Reference (policy objectives)

Stability Guarantee:

$$\frac{d\gamma}{dt} < 0 \implies \text{instability}$$

Declining coherence signals system degradation *before* catastrophic failure.

Key Property

The system is **self-correcting**: low coherence blocks state transitions, forcing process improvement before governance can proceed.

Historical Context

Direct Democracy 1.0

- Athens, 500 BCE
- Physical presence
- Lottery selection
- No scalability

Representative Democracy

- 18th century onward
- Delegation to representatives
- Periodic elections
- Principal-agent problems

Liquid Democracy

- 2000s concept
- Transitive delegation
- Vote on anything
- Attack surface expansion

Augmented Democracy

- 2020s emergence
- Procedural coherence
- Adversarial resistance
- Infrastructure, not oracle

Failure Modes and Mitigations

Technical Failures

- Entropy source compromise
- Oracle manipulation
- Smart contract bugs

Mitigations:

- Multiple entropy sources
- Decentralized oracles
- Formal verification

Social Failures

- Curator capture
- Credential concentration
- Apathy decay spiral

Mitigations:

- Curator rotation
- Credential caps
- Participation incentives

Implementation Status

Reference Implementation:

- Substrate-based runtime (Rust)
- EVM compatibility layer (Solidity)
- Quantum entropy integration
- IPFS artifact storage

Deployment Targets:

- DAO governance frameworks
- Municipal decision-making pilots
- Corporate stakeholder voting
- Academic institution governance

Open Source: github.com/paraxiom/augmented-democracy

The Scope Claim

What We Claim

Democratic legitimacy is a **measurable property of process quality**, independent of specific outcomes.

What We Do Not Claim

- That coherent processes produce "correct" outcomes
- That the system can determine truth
- That algorithms should replace human judgment
- That this solves all governance problems

Infrastructure enables legitimate disagreement.

Conclusion: Democracy as Infrastructure

Core Thesis

The fundamental challenge of democratic governance is **procedural integrity under adversarial conditions**—and this challenge admits algorithmic solutions that do not require resolving contested questions of truth.

Key Takeaways:

1. Process quality is measurable without semantic authority
2. Coherence gates complement majority voting
3. Test grids verify engagement, not correctness
4. The system constrains process, not outcomes

Questions?

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Thank You

Augmented Democracy: Procedural Coherence in Algorithmically Mediated Governance

Paper: `paper-core.pdf`
Appendices: `paper-appendix.pdf`
Code: github.com/paraxiom/augmented-democracy